Documentation of Environmental Indicator Determination
Interim Final 2/5/99
RCRA Corrective Action
Environmental Indicator (EI) RCRA Info code (CA725)
Current Human Exposures Under Control

Facility Name: **Merck and Company, Inc.**
Facility Address: **Highway 340 South, Elkton, Milford, VA 22827**
Facility EPA ID #: **VAD001705110**

1. Has **all** available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   ✓ If yes - check here and continue with #2 below.

   _____ If no - re-evaluate existing data, or

   _____ if data are not available skip to #6 and enter "IN" (more information needed) status code.

BACKGROUND
Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRA Info as long as they remain true (i.e., in RCRA Info status codes must be changed when the regulatory authorities become aware of contrary information).

2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

	Yes	No	?	Rationale / Key Contaminants
Groundwater	✓			VOCs, SVOCs
Air (indoors)[2]		✓		
Surface Soil (<2 ft)		✓		
Surface Water		✓		
Subsurf. Soil (>2 ft)	✓			VOCs, SVOCs
Air (outdoors)	✓			VOCs, SVOCs

_____ If no (for all media) - skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

✓ If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

_____ If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):
See attached page

("Unknowns" are carried through with "Yes" determinations to ascertain what information is needed or if risks are negligible.)

Footnotes:

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

[2] Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile

contaminants) does not present unacceptable risks.

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Section 1 attachment – Rationale and References

1. Groundwater – YES

REFERENCE: 1) *Sanitary Landfill Permit #183, November 2002 Semi Annual Groundwater Monitoring Results, 2) Site-wide Bedrock Groundwater Sampling Report August 2003 and November 2004 Events, 3) Monitored Natural Attenuation Report March 2005 Sampling Event, 4) Results of Biosparging Pilot Tests Performed in Groundwater North of the Landfill (July 2005)*

RATIONALE: At the landfill's point of compliance wells which are nearest to the river, the key contaminants above the drinking water MCLs are: Benzene, Chlorobenzene, Chloroform, Methylene Chloride, Naphthalene, Trichloroethene, Vanadium, and Vinyl Chloride.

2. Air (indoors) – NO

REFERENCE: 1) *Source-Area Verification Report*, September 1993; 2) *Results of the Fall 1999 Site-Wide Groundwater Sampling Event*; May 2002, 3) *Site-wide Bedrock Groundwater Sampling Report August 2003 and November 2004 Events, Monitored Natural Attenuation Report March 2005 Sampling Event, 4) Results of Biosparging Pilot Tests Performed in Groundwater North of the Landfill (July 2005)*

RATIONALE: There are levels of VOCs (benzene and diethylbenzene) above RBC values for soil ingestion in subsurface soils at the facility. Also, the levels of many VOCs in the groundwater exceed applicable MCLs/ACLs at wells located throughout the facility. However, there are no occupied enclosed buildings located directly above or nearby the plume, therefore indoor air at the facility is not expected to be impacted.

3. Surface Soil – NO

REFERENCE: 1) *Source-Area Verification Report*, September 1993; 2) *Source-Area Characterization Report*, August 1994; 3) *Final RCRA Facility Investigation Report*, August 1995

RATIONALE: Inorganic constituents detected in surface soils were found to be within naturally-occurring ranges or below RBC values for soil ingestion. Although levels above RBC values for soil ingestion were found of PCB-1254 and benzo(a)-pyrene, detectable levels of VOCs and SVOCS were found in surface soils throughout the facility. However, the Human Health Baseline Risk Assessment indicates that levels of contaminants do not exceed acceptable risk-based levels.

4. Surface Water – NO

REFERENCE: *Results of November 2004, February/March 2005, May 2005, and August 2005 Surface Water Sampling Event Reports for the Stonewall Plant, Elkton, Virginia*.

RATIONALE: After conducting 4-surface water sampling events on the South Fork of the Shenandoah River during the last 9 months there were neither organics nor inorganics detected above quantitation levels. During the last two events each constituent tested was reported as below the approved detection limit. At no point, has any constituent exceeded the Virginia Water Quality Standards for Health-based Protection for Fish Consumption or Drinking Eater Protection.

5. Subsurface Soil – YES

REFERENCE: 1) *Source-Area Verification Report*, September 1993; 2) *Source-Area Characterization Report*, August 1994; 3) *Final RCRA Facility Investigation Report*, August 1995

RATIONALE: Inorganic constituents detected in subsurface soils were found to be within naturally-occurring ranges or below RBC values for soil ingestion. Levels above RBC values for soil ingestion of several VOCs and SVOCs were found in subsurface soils at the facility.

6. Air (outdoors) – YES

REFERENCE: 1) *Source-Area Verification Report*, September 1993; 2) *Results of the Fall 1999 Site-Wide Groundwater Sampling Event*; May 2002; 3) *Sanitary Landfill Permit #183, November 2002 Semi Annual Groundwater Monitoring Result,4*) *Site-wide Bedrock Groundwater Sampling Report August 2003 and November 2004 Events, Monitored Natural Attenuation Report March 2005 Sampling Event, 5) Results of Biosparging Pilot Tests Performed in Groundwater North of the Landfill (July 2005*

RATIONALE: Levels of VOCs (benzene and diethylbenzene) above RBC values for soil ingestion were found in subsurface soils at the facility. The levels of several VOCs in the groundwater exceed applicable MCLs/ACLs at wells located throughout the facility.

3. Are there **complete pathways** between "contamination" and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table

Potential **Human Receptors** (Under Current Conditions)

Contaminated Media	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food[3]
Groundwater	NO	NO	NO	YES			NO
~~Air (indoors)~~							
~~Soil (surface, e.g., <2 ft)~~							
~~Surface Water~~							
Soil (subsurface e.g., >2 ft)				YES			NO
Air (outdoors)	NO	NO	NO	YES	NO		

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated" as identified in #2 above.

2. enter "yes" or "no" for potential "completeness" under each "Contaminated" Media -- Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

_____ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

__✓__ If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation.

_____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):
Groundwater - see attached page, Item #1
Soil (subsurface) - see attached page, Item #2
Air (outdoors) - see attached page, Item #3

[3] Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

1. Groundwater

REFERENCE: All available information within the Department files.

RATIONALE:

Residents

NO – There is no information indicating the presence of residents on the facility.

Workers

NO – Based on our records potable wells have shown no evidence of contamination

Day-Care

NO – There is no information indicating the presence of a day-care on the facility.

Construction

YES – Exposure to groundwater potentially contaminated may occur during construction activities. Furthermore, the depth to groundwater (on average) is 10 feet below grade. Construction activities would be covered by the facilities heath and safety plan.

Food

NO – There is no information indicating that food is grown or comes into contact with contaminated groundwater at the facility.

2. Soil (subsurface)

REFERENCE: All available information within the Department files.

RATIONALE:

Construction

YES – Exposure to contaminated subsurface soils may occur during construction activities. Specifically, exposure to contaminated subsurface soils at the landfill cannot occur since a hazardous waste cap has been constructed and the post-closure care permit prohibits any disturbance of the cap. Other areas where potential soil exposures could occur have been addressed through the Corrective Action program.

Food

NO – There is no information indicating that food is grown in or comes into contact with contaminated subsurface soils at the facility.

3. Air (outdoors)

REFERENCE: All available information within the Department files.

RATIONALE:

Residents

NO – There is no information indicating the presence of residents on the facility.

Workers

NO – There is no information indicating that workers are exposed to contaminated outdoor air from the subsurface soils. Recent vapor intrusion guidance indicates that contamination deeper than 5 vertical feet from the indoor air space need not be considered. Applying the same rationale to ground surface and outdoor air, and dilution is considered, then it is reasonable to conclude that

workers will not be exposed to potentially contaminated outdoor air (resulting from contaminated groundwater).

Day-Care
NO – There is no information indicating the presence of a day-care on the facility.

Construction
YES – Exposure to potentially contaminated outdoor air may occur during construction activities.

Trespassers
NO – The depth to the overburden water table appears to be a minimum of 10ft at the northern portion of the facility. The depth to bedrock groundwater table appears to be generally greater than 50ft and decreasing to 10-15ft north of the landfill. Recent vapor intrusion guidance indicates that contamination deeper than 5 vertical feet from the indoor air space need not be considered. If the same logic is applied to ground surface and outdoor air, and dilution is considered, then it is reasonable to conclude that trespassers will not be exposed to potentially contaminated outdoor air (resulting from contaminated groundwater).

4. Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be **"significant"**[4] (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

_____ If no (exposures can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

__✓__ If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are expected not to be "significant."

_____ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

Rationale and Reference(s):
See attached page

("Unknowns" are carried through with "Yes" determinations to ascertain what information is needed or if risks are negligible.)

[4] If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

1. Groundwater

REFERENCE: All available information within the Department files.

RATIONALE:

Construction

YES – High levels of organics contamination (even exceeding TCLP levels for constituents such as benzene, carbon tetrachloride, and chloroform) have been found in the groundwater during recent sampling events. Although construction activities tend to be intermittent, relatively short duration events, such high levels of groundwater contamination may result in significant exposures even though the exposure duration is low.

2. Soil (subsurface)

REFERENCE: All available information within the Department files.

RATIONALE:

Construction

YES – Levels above RBC values for soil ingestion of several VOCs and SVOCs were found in subsurface soils at the facility. Although construction activities tend to be intermittent, relatively short duration events, such levels of subsurface soils contamination may result in significant exposures even though the exposure duration is low.

3. Air (outdoors)

REFERENCE: All available information within the Department files.

RATIONALE:

Workers

NO – There is a relatively low magnitude of exposure of workers to potentially contaminated outdoor air at the facility. There is no information indicating that workers are exposed to contaminated outdoor air from the subsurface soils and if dilution is considered, then it is reasonable to conclude that workers will not be exposed to potentially contaminated outdoor air (resulting from contaminated groundwater).

Construction

Yes – Although construction activities tend to be intermittent, short duration events (thus, relatively lower magnitude exposures), the greater proximity to and disturbance of contamination sources may result in exposures to relatively higher concentrations in potentially contaminated outdoor air.

Trespassers

NO – There is a relatively low magnitude of exposure of trespassers to potentially contaminated outdoor air at the facility. There is no information indicating that trespassers are exposed to contaminated outdoor air from the subsurface soils and if dilution is considered, then it is reasonable to conclude that trespassers will not be exposed to potentially contaminated outdoor air (resulting from contaminated groundwater).

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5. Can the "significant" **exposures** (identified in #4) be shown to be within **acceptable** limits?

✓ If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

_____ If no (there are current exposures that can be reasonably expected to be "unacceptable")- continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

_____ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code

Rationale and Reference(s):
See attached page

1. Groundwater

REFERENCE: All available information within the Department files.

RATIONALE:

Construction

YES – Areas of groundwater contamination are well delineated throughout the facility, and any construction activities that may come into contact with contaminated groundwater shall be handled pursuant to the facilities Haeth and Safety Plan.

2. Soil (subsurface)

REFERENCE: All available information within the Department files.

RATIONALE:

Construction

YES – Areas of subsurface soil contamination are well delineated throughout the facility, and any construction activities that may come into contact with such contamination are being conducted pursuant to the remedies specified in the facility's RCRA Corrective Action Permit. Therefore, any significant exposures to subsurface soil contamination shall be held to acceptable limits.

3. Air (outdoors)

REFERENCE: All available information within the Department files.

RATIONALE:

Workers

N/A – All areas where contaminated subsurface soil and groundwater may contribute to potentially contaminated outdoor air are industrialized workplaces. By applying the same logic to outdoor air as provided for indoor air in the *Vapor Intrusion and RCRA Corrective Action (CA) Environmental Indicators (EI) Fact Sheet* (EPA Region III; Draft 6/17/03 Rev.), the Occupational Safety and Health Administration (OSHA) will take the lead in addressing occupational exposures. Therefore, the determination of whether or not exposures of workers to potentially contaminated outdoor air are within acceptable limits will be left to OSHA and not be addressed in this EI.

Construction

N/A – All areas where contaminated subsurface soil and groundwater may contribute to potentially contaminated outdoor air are industrialized workplaces. By applying the same logic to outdoor air as provided for indoor air in the *Vapor Intrusion and RCRA Corrective Action (CA) Environmental Indicators (EI) Fact Sheet* (EPA Region III; Draft 6/17/03 Rev.), the Occupational Safety and Health Administration (OSHA) will take the lead in addressing occupational exposures. Therefore, the determination of whether or not exposures of construction workers to potentially contaminated outdoor air are within acceptable limits will be left to OSHA and not be addressed in this EI.

Trespassers

YES – A Human Health Baseline Risk Assessment (HHBRA) was provided in the *Final RCRA Facility Investigation Report* (August 1995). The HHBRA considered the construction worker inhalation (VOCs in indoor air from subsurface soils) pathway and concluded that there is not an unacceptable risk. In the absence of more recent subsurface soils data, it is reasonable to assume that the data upon which the HHBRA was based represents the worst case, i.e., the levels of VOCs will have decreased over time due to attenuating effects such as leaching and volatilization. Also,

the magnitude of exposure likely to be encountered by a trespasser would be much less than that of a construction worker. Therefore, it is reasonable to conclude that any exposures of potentially contaminated outdoor air (from contaminated subsurface soils) to trespassers are currently within acceptable limits.

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6. Check the appropriate RCRA Info status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

✓ YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the Merck & Co., Inc. - Stonewall Plant facility, EPA ID # VAD001705110 , located at Elkton, Virginia under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

_____ NO - "Current Human Exposures" are NOT "Under Control."

_____ IN - More information is needed to make a determination.

Completed by original signed Date 9-22-05
(print) Matthew M. Stepien
(title) Environmental. Engineer. Sr.

Supervisor original signed Date 9-26-05
(print) Leslie A. Romanchik
(title) Director, Office of Waste Permitting
(EPA Region or State) VA DEQ

Locations where References may be found:

VA Department of Environmental Quality, Office of Waste Permitting files

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FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.